Social Response to NWS Warnings:

Achieving Greater Tornado Warning Response

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Why were there so many deaths this year from tornadoes?

Deadliest Single Tornadoes

Note: Some of these events that occurred prior to the era of comprehensive damage surveys may have been composed of multiple tornadoes along a damage path. Death counts for events in the 1800s and early 1900s should be treated as estimates, since recordkeeping of tornado deaths was erratic at that time.

(Source: Grazulis for pre-1950, NOAA/NWS data for post-1950)

Tornado	Fatalities	Date
Tri-State (Missouri/Illinios /Indiana)	695	March 18, 1925
Natchez, Mississippi	317	May 6, 1840
St. Louis, Missouri	255	May 27, 1896
Tupelo, Mississippi	216	April 5, 1936
Gainesville, Georgia	203	April 6, 1936
Woodward, Oklahoma	181	April 9, 1947
Joplin, Missouri	**157 (est.)**	**May 22, 2011**
Amite LA, Purvis, Mississippi	143	April 24, 1908
New Richmond, Wisconsin	117	June 12, 1899
Flint, Michigan	116	June 8, 1953

Single Day Tornado Fatalities

Single Day Outbreak Number of Fatalities Records: Source: Grazulis for pre-1950, NOAA/NWS data for post-1950

Date	Eyewitness Reports
March 18, 1925	747
March 21, 1932	332
May 17, 1840	317
April 27, 2011	**320** (NOAA data)
April 3, 1974	310 (NOAA data - US only)
May 27, 1896	305
April 11, 1965	260 (NOAA data)
April 5, 1936	249

Deadliest Tornado Years in US History

(Official NOAA-NWS Record: 1950 - present; Research by Grazulis: 1875-1949)

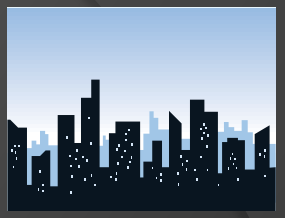
Year	Fatalities
1925	794
1936	552
1917	551
2011	**549**
(157 in Joplin)	
1927	540
1896	537
1908	477
1909	404
1932	394
1942	384
1924	376
1974	366
1933	362

EF5/F5 tornadoes

Location	Date	Deaths
Calumet-El Reno-Piedmont-Guthrie OK	May 24, 2011	9
Joplin, MO	May 22, 2011	159
Rainsville/Dekalb, AL	April 27, 2011	23
Preston, MS	April 27, 2011	3
Hackleburg/Phil Campbell, AL	April 27, 2011	72
Smithville, MS	April 27, 2011	23
Parkersburg, IA	May 25, 2008	9
Greensburg, KS	May 4, 2007	11
Bridge Creek/Moore OK	May 3, 1999	36
Waynesboro, TN	April 16, 1998	3
Oak Grove/Pleasant Grove, AL	April 8, 1998	32
Jarrell, TX	May 27, 1997	27

Why such a discrepancy in the number of deaths?

SOME FACTORS:



WHERE DO MOST PEOPLE LIVE?

STRENGTH/SPEED OF THE TORNADO?

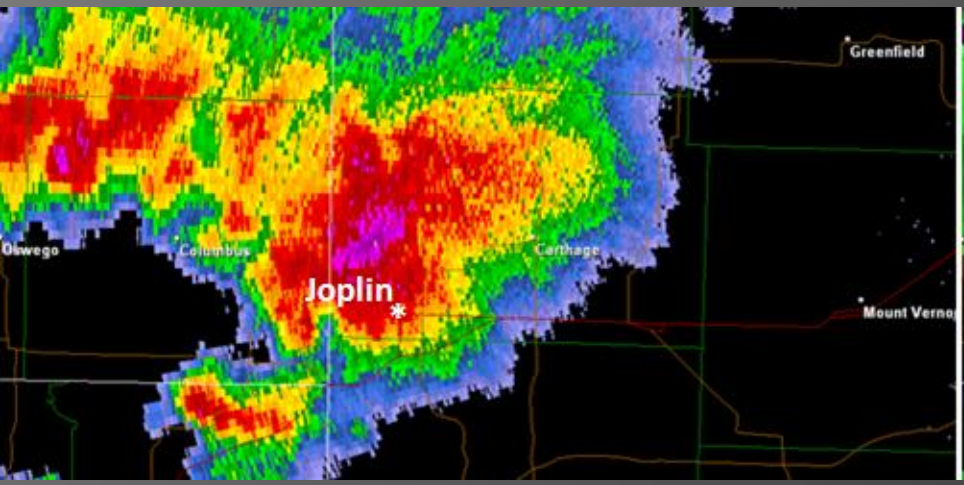
WHEN DOES THE TORNADO OCCUR?

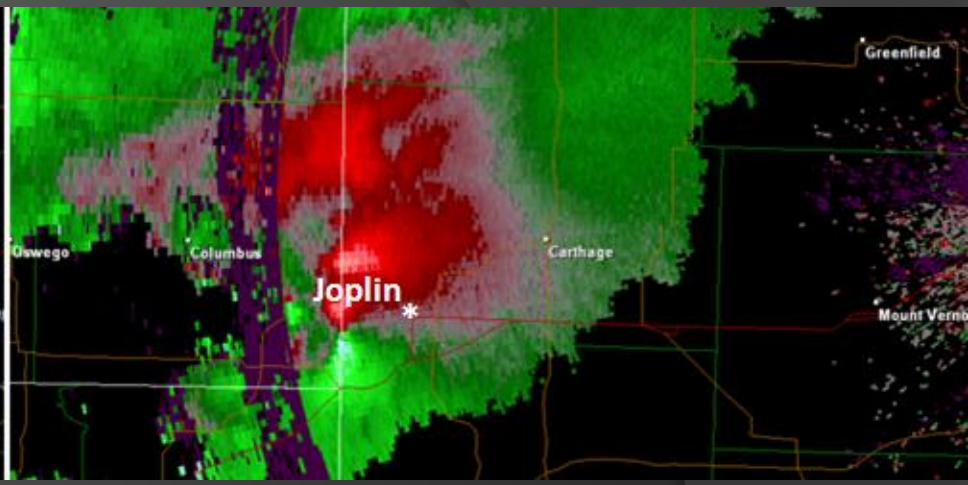
ARE YOU IN FAMILIAR TERRITORY?

HOW DO YOU GET THE WARNING?

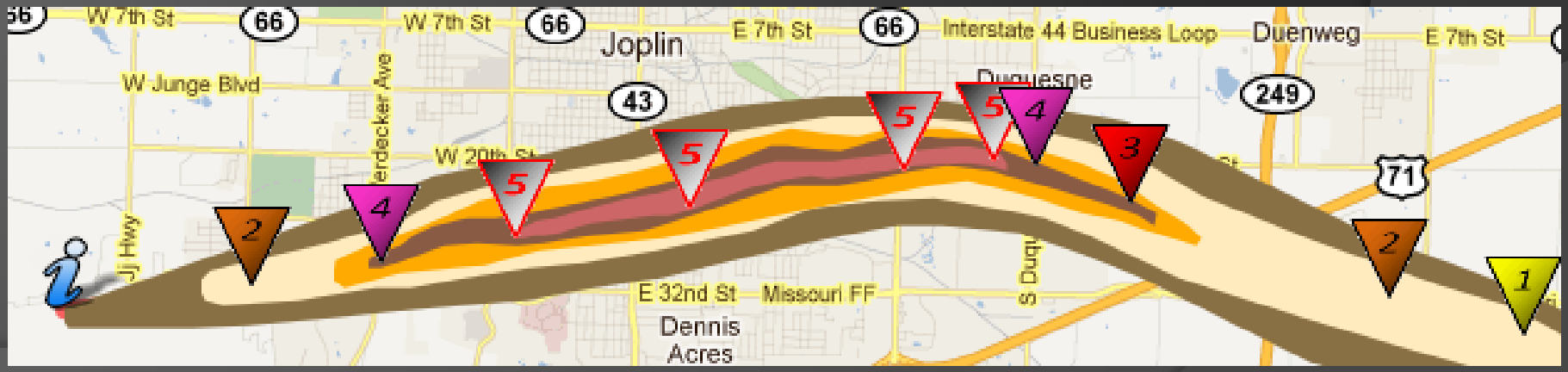
WHAT TYPE OF STRUCTURE ARE YOU IN?

AN UNPREDICTABLE FACTOR: *THE STORM*





- Even though the storm was warned for, there were no reports of tornadoes prior to the storm entering Joplin. (No history)
- The tornado touched down just outside the Joplin city limits and intensification occurred very rapidly →EF4/EF5 within a few minutes



Destructive Joplin, MO Tornado

May 22, 2011

Basehunters
Colt Forney, Kevin Rolfs,
Isaac Pato, and Scott Peake

THE HUMAN FACTOR: *Personalizing the threat*

Optimism Bias (under-estimating the likelihood of a negative event):
"I don't believe there will be a tornado"
"It's not going to hit me, it'll hit somewhere else, it always does."
Complacency:
"So many tornado warnings, and nothing ever happens, why bother?"
"The sirens go off all the time, I am ignoring it"
Folk Science:
"The river/hill will protect me from tornadoes"

Perception of risk:
Need to confirm there is a warning or a tornado
"I need to find out more information before acting"
Need to hear sirens
Need to see actual tornado/debris
Is my exact location in the path?
How concerned does TV meteorologist seem?

Personal preparedness/response:

Do you have plans on what to do?
Do you know what to do, where to go, not to go?
When to take shelter/when do I feel threatened?
How long will it take to get to shelter
Do you understand what the warning says

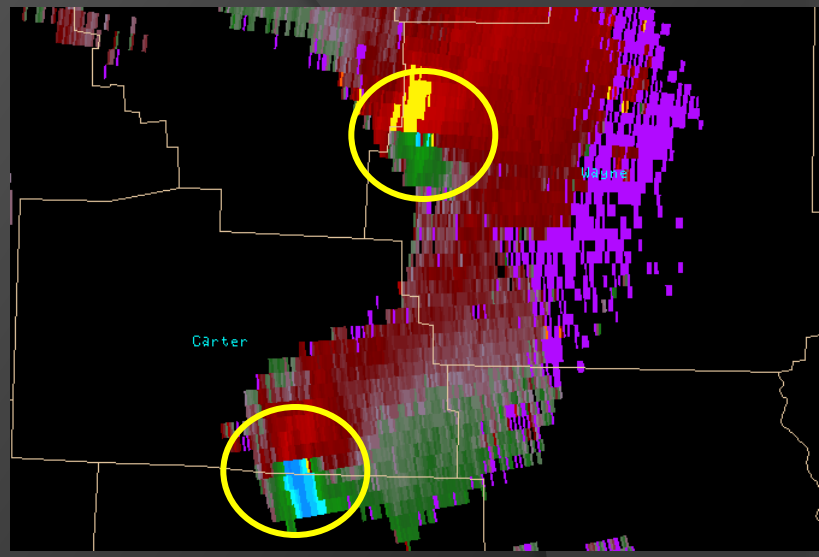
Personal Emotions: Alters ability to react

Do you panic easily?
Do you get major anxiety when severe weather is forecast?
Are you claustrophobic?

Recognizing a tornado:

Tornado is wrapped in rain
Night time tornado
Large wedge tornado – a mile wide
Large debris cloud – not your typical looking tornado

Strengths/Limitations of the WSR-88D…

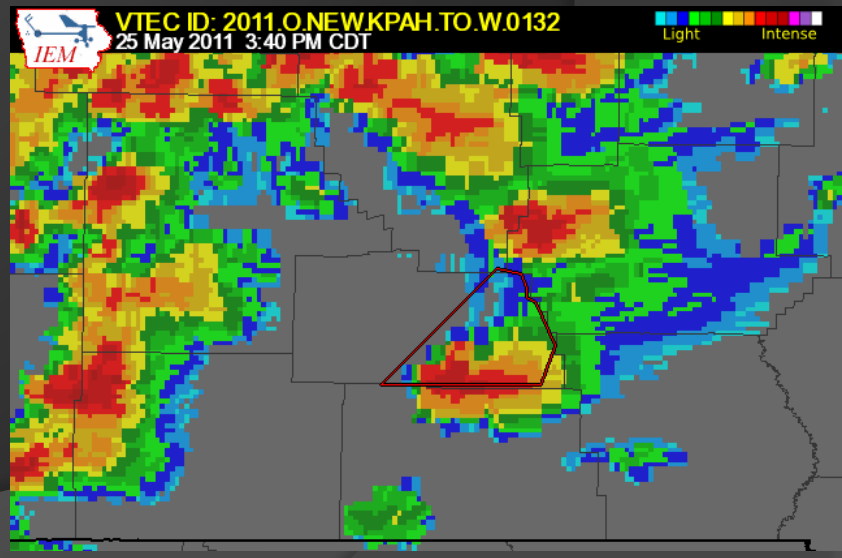


Strengths: What can it do?

- Detect circulations with a storm
- Determine strength/depth of circulation
- Track circulations

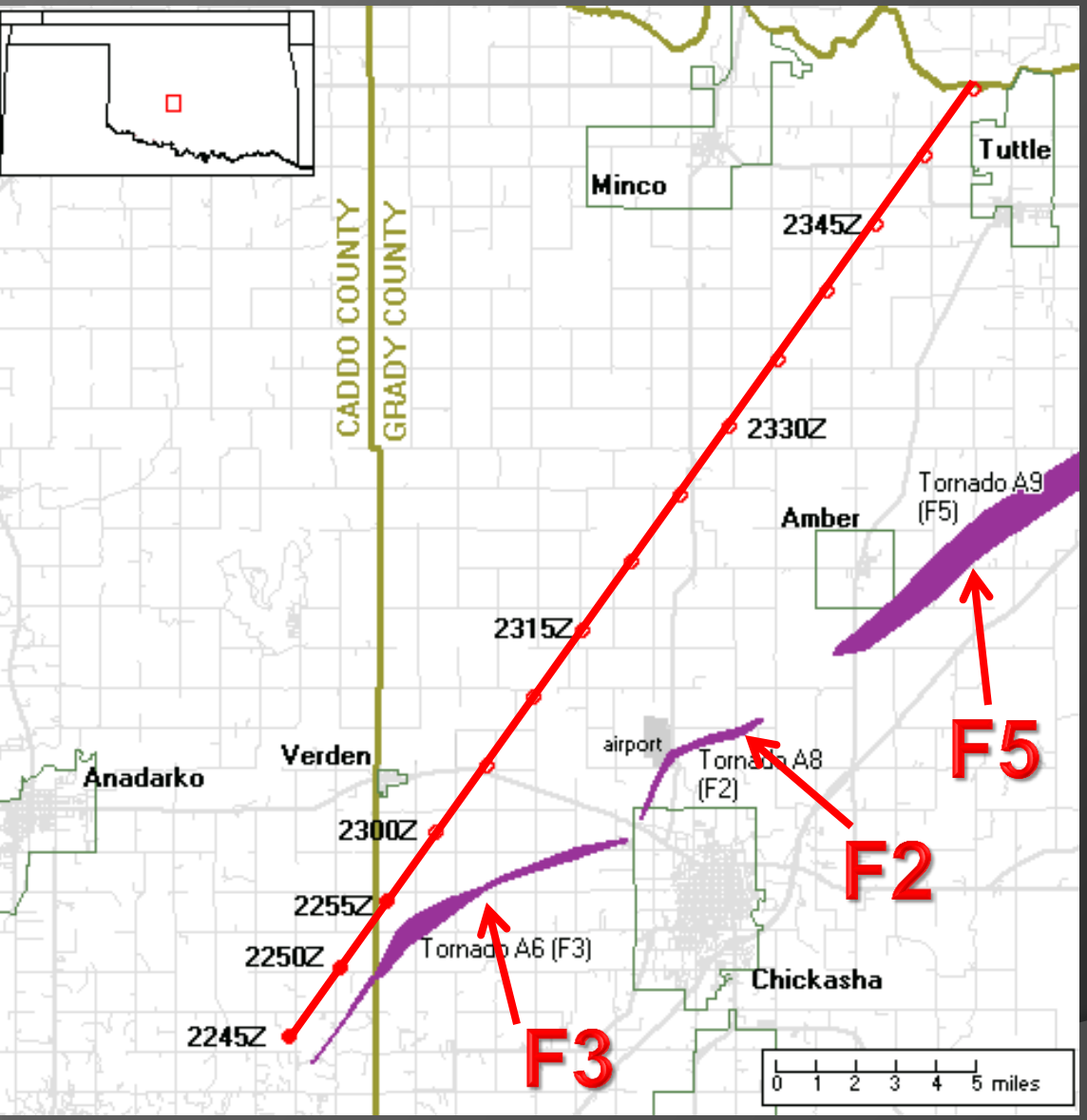
The radar CANNOT:

- show with 100% accuracy that there is in fact a tornado occurring.
- pinpoint the exact location of a possible tornado nor its exact path.
- pinpoint the exact time of touchdown nor the exact time a tornado will hit your home.



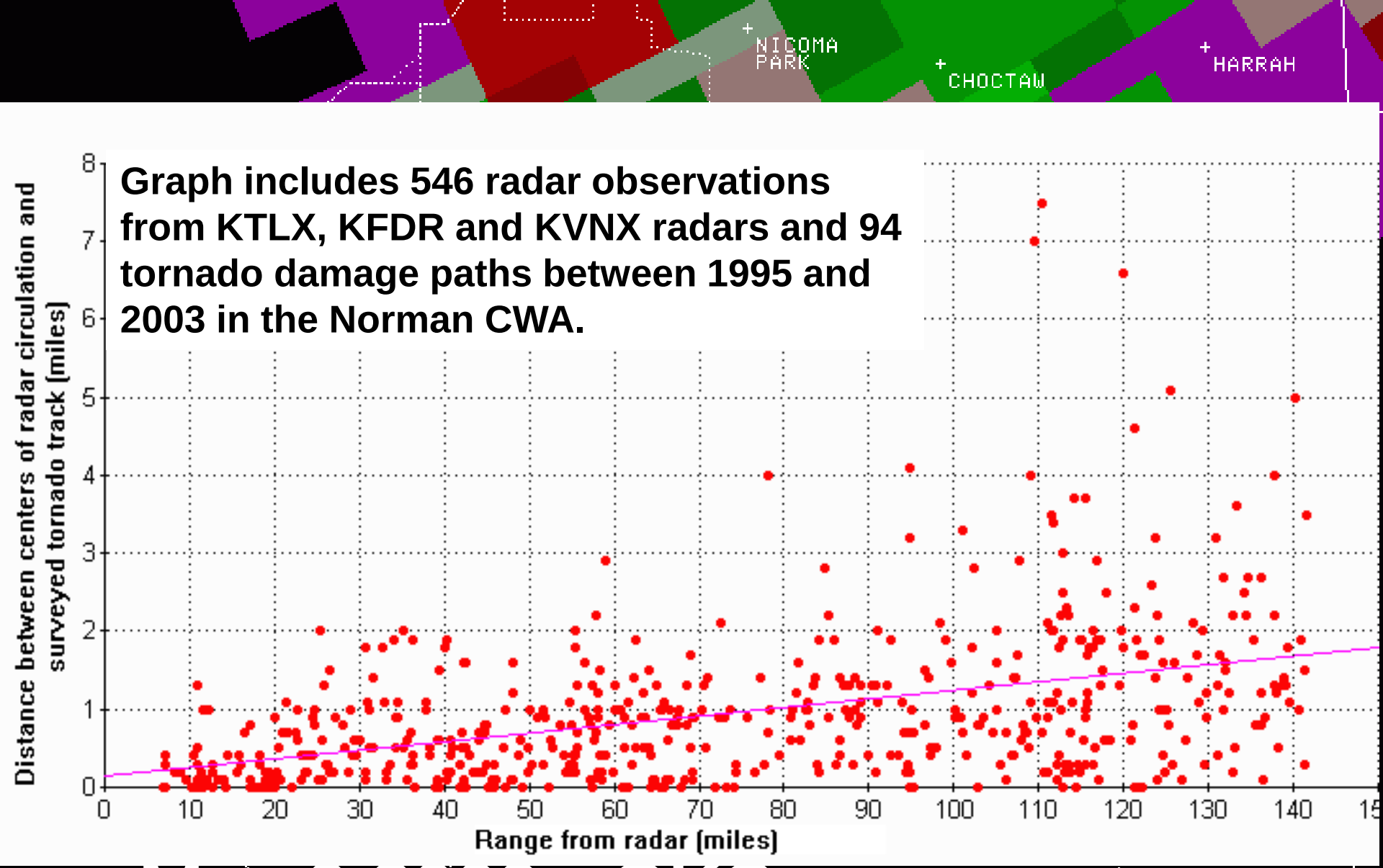
The tornado is NOT always directly below the rotational signature

Specificity can have serious implications



There are a number of meteorological, mechanical, and mapping uncertainties inherent in radar data.

We need to understand these limitations in order to give accurate information without conveying a false sense of precision.



May 8 2003 - OKC
104 nm away F4 Tornado

Examples of how the NWS tells you where the storm is headed:

* LOCATIONS IN THE WARNING INCLUDE BUT ARE NOT LIMITED TO RICE... TAMAROA...ST. JOHNS...PINCKNEYVILLE AND DU QUOIN.

* THE TORNADO WILL OTHERWISE IMPACT MAINLY RURAL AREAS OF THE INDICATED COUNTY.

VS.

* THE TORNADO WILL BE NEAR...
CANTON BY 925 PM
CADIZ BY 935 PM
CERULEAN BY 945 PM

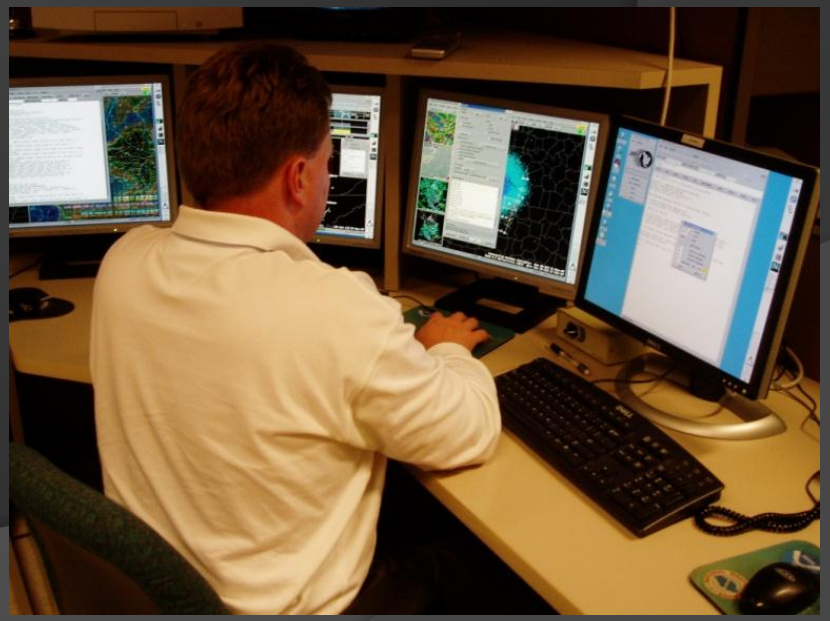
Some people take these times as gospel – this can spell trouble!

Why Do We Issue Warnings…

Warnings are issued because we feel that the risks are great enough that you need to know about them.

They are meant to give you enough time to take action.

- Of course, we do not always get warnings out before something happens.
- If you feel threatened by a storm, take cover, do not wait for a warning.
- Common sense should be used.



How Do We Issue Warnings…

We break the warning methodology down into 3 main points:

Environment

- ✓Does the environment support the development of severe thunderstorms, or in particular, tornadoes

Spotters

- ✓ Do we have any real-time, accurate spotter reports?

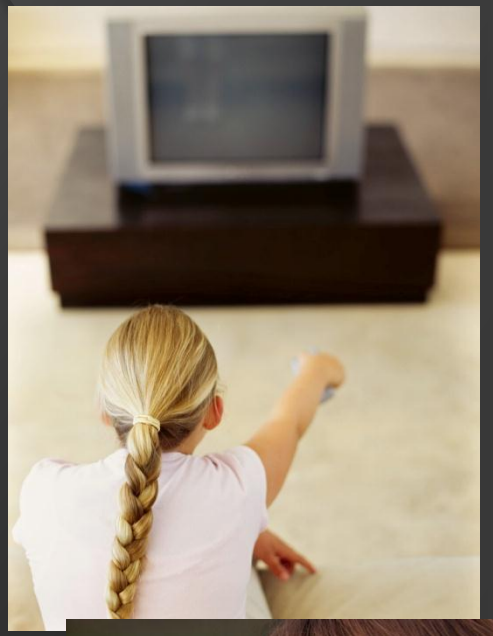
Radar

- ✓Does what we see on radar support tornadoes?

If 2 out of the 3 points above suggest the existence or possible tornado development, then a tornado warning should be issued.

Social Response-Think Ahead

"Just less than half reported their first indication of a severe weather threat was in the moments just prior to the tornado."



- Know what to expect/how to react
- Devoting time to being prepared - increase your chances for survival.
- The more you know and the more prepared you can be – the better!
- Everyone's particular situation is going to be different.
- Plan your day AROUND the weather.
- Be ready to act accordingly and quickly if bad weather threatens.

Social Response-Warnings

Get the warning – read the text

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BULLETIN - EAS ACTIVATION REQUESTED
TORNADO WARNING
NATIONAL WEATHER SERVICE PADUCAH KY
1215 PM CDT MON JUN 27 2011

THE NATIONAL WEATHER SERVICE IN PADUCAH HAS ISSUED A

* TORNADO WARNING FOR...
  SOUTHEASTERN POPE COUNTY IN SOUTHERN ILLINOIS...
  SOUTHERN LIVINGSTON COUNTY IN WESTERN KENTUCKY...

* UNTIL 1245 PM CDT.

* AT 1213 PM CDT...NATIONAL WEATHER SERVICE DOPPLER RADAR DETECTED A
  SEVERE THUNDERSTORM CAPABLE OF PRODUCING A TORNADO NEAR
  HAMLETSBURG...MOVING EAST AT 35 MPH.

* LOCATIONS INCLUDE...
  SMITHLAND...
  HAMLETSBURG...

PRECAUTIONARY/PREPAREDNESS ACTIONS...

NOW IS THE TIME TO IMPLEMENT YOUR TORNADO PLAN OF ACTION. SEEK
SHELTER INDOORS IN A BASEMENT...OR IN AN INTERIOR ROOM ON THE LOWES
FLOOR OF A HOME OR BUILDING.

&&

LAT...LON 3726 8830 3707 8827 3706 8846 3720 8848
TIME...MOT...LOC 1715Z 268DEG 31KT 3713 8843
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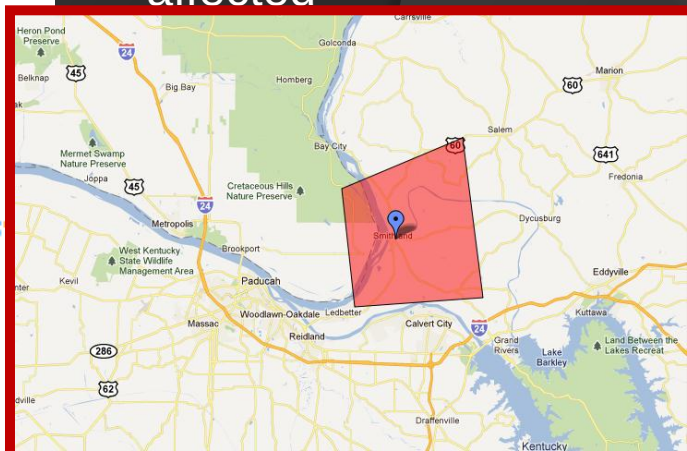
Type of warning

What county(s) affected

Valid time of warning

What's the storm's location and movement

Some, but not all towns affected



Social Response-Warnings

Finding ways to better communicate the message…

"Perhaps we don't do that (communicate) in ways that people understand the threat." Harold Brooks – research meteorologist NSSL

-How do we get people to react properly
-How do we provide them the most useful/effective information to make good decisions?

- **Hype up potential high end events**
- **Use improved and more dramatic wording in the warnings**
  - **-Need to put the pertinent information into warnings and statements.**
  - **-Re-arrange the warning to put that information first?**
  - **-Add more life saving call to action statements**

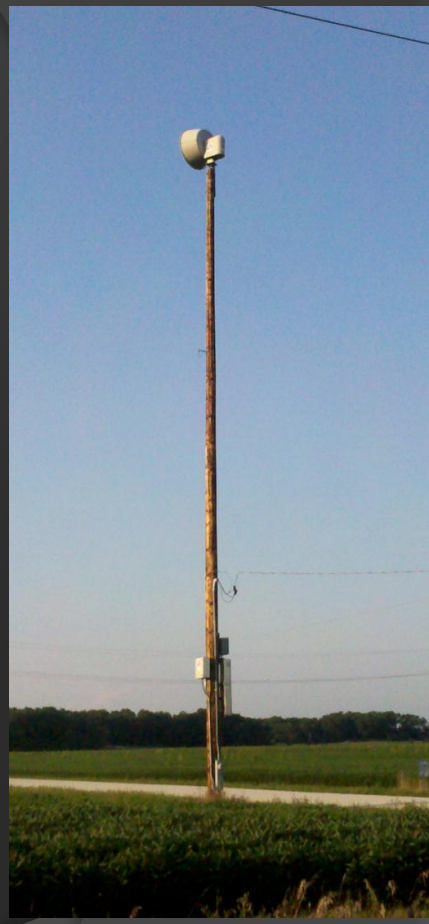
Facts about NOAA Weather Radios…

- We realize NOAA weather radio is becoming more of an alarm then the *single* source of pertinent weather information.
- However, many people still do not have or do not use a weather radio for several reasons.
- Common complaint: “My weather radio goes off too much!!”
  - This can cause an increased chance of death since many people choose to turn their radio OFF.
- When are better weather radios going to be developed in order to display the polygon warnings?

Facts about sirens…

- Designed to warn people who are outside of impending danger, not people indoors.
- Source of uncertainty/vagueness
- The NWS *does not* control when or where outdoor sirens are sounded.

  -Under control of the local government of the city, town or community.
- If the power goes out, sometimes sirens will not sound unless they are on backup power.
- Heavy rain, hail or high winds can mask the sound of the siren, making it difficult to hear.



Advertise local siren policy

Power Outages

- Power outages – blamed for some deaths in the Alabama tornadoes.
  - Many people without power when afternoon storms hit.
  - *"I'm pretty positive that 90 percent of the people who got hit didn't know it was coming," Rainsville City Councilman*
  - No warnings transmitted on NOAA Weather Radio – lines down on at least one tower
  - People more concerned about hardships related to power outage than the weather - preoccupied
  - Forces you to have to think about other options
- Make sure you have alternate means to get the latest information.

Social Response:

False Alarms – Can Cause Complacency

- Warning issued = nothing happened.
- Tornadoes are rare and most are usually fairly small events and impact only so much ground.
- Tornado may have been nearby, just not at your specific location.
- Other times, the complaints are verified - nothing did happen.
- The NWS is trying to work on this problem…More from Chris

Social Response:

False Alarms: Two sides of the coin

"I can't tell you how many warnings I get that never pan out. I understand they have to issue the warning, but maybe a little too much."

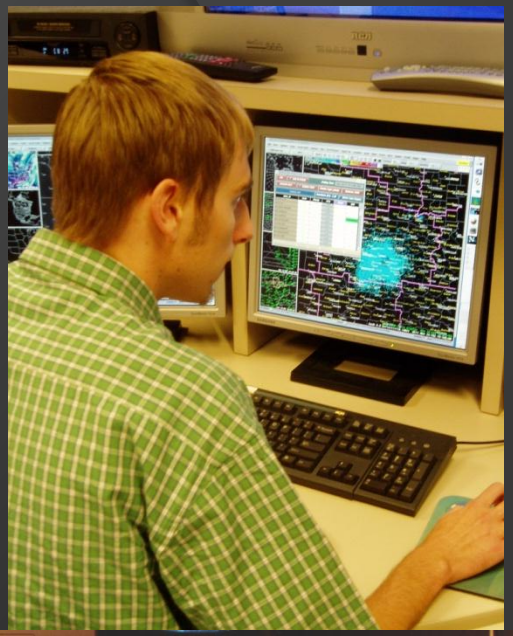
VS

"Hey, better safe than sorry. If they don't say anything and there is a tornado, people will cry about that too. 13 warnings but no tornadoes is better than no warnings and 1 tornado for me. If I choose to ignore the warnings, than it's my fault."

We need to find a way to not let the false alarms dictate how people should react.

Why Should You Listen?

- Close to *300 years* combined years of experience dealing with severe weather.
- Hundreds of hours of training dealing with severe weather.
- Not a hobby - We take our job very seriously!
- The detection of tornadoes is a long way off from being perfect.
  - Still a lot we don't know



Bottom Line...

- ***You*** are responsible for your reactions or non reactions to an event with or without a warning.
- Your best bet is to prepare and hope you never have to use it.


Questions/Comments?
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Photo/Jeff Roberson